

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Meagan S. Walling (Reg. No. 61,715), the attorney in record, gave authorization for this Examiner's Amendment over the telephone during an interview. The claims amendments are as follow:

PLEASE AMEND THE CLAIMS AS FOLLOWS:

1. (Previously Presented) A process for validating a state of a storage area network (SAN), comprising the steps of:

defining a SAN access path policy representative of SAN logical access paths, said SAN logical access paths defining end-to-end access relationships between an application on a server, a sequence of one or more switches and physical links in the SAN, and data LUNs stored on storage devices in the SAN and having for the logical access paths an associated set of logical access path attributes consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, wherein the SAN access path policy includes a list of valid access paths and an associated set of access path attributes for the valid access paths,

collecting configuration information from devices of the SAN, standardizing formats of the configuration information and reconciling conflicts,

processing the collected configuration information to identify the SAN logical access paths, and computing the associated access path attribute values, defining a state of the SAN based on SAN logical access path attribute values associated with the SAN logical access paths, the attribute values consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, and

comparing the identified SAN logical access paths and computed access path attribute values with the list of valid access paths and associated set of access path attributes for the valid access paths in the SAN access path policy to identify any logical access path discrepancies or violations, thereby validating the state of the SAN.

2. (Previously Presented) The process of claim 1, and further including identifying a logical access path violation if at least one identified SAN logical access path is in disagreement with the list of valid access paths and associated set of access path attributes for the valid access paths in the SAN access path policy.

3. (Original) The process of claim 1, and further including defining a SAN notification policy for notifying a user about SAN logical access path violations.

Art Unit: 2457

4. (Original) The process of claim 3, wherein notifying a user includes sending a message to the user with violation information, said message selected from the group consisting of email, graphic text and SNMP messages.

5. (Previously Presented) The process of claim 1, and further including identifying partial logical access paths, and comparing logical access path attribute values of the partial paths with the SAN logical access path policy.

6. (Original) The process of claim 1, wherein said configuration information includes device properties selected from the group consisting of server ID, server port configuration, switch port configuration, switch ID, switch IP and domain ID, grouping of devices, zoning of devices, storage device ID, LUNs of storage devices, and LUN masks.

7. (Previously Presented) The process of claim 1, wherein a logical access path attribute further comprises an access path attribute selected from the group further consisting of bandwidth, component interoperability, proximity constraints, and type of component authentication.

Art Unit: 2457

8. (Original) The process of claim 1, and further comprising user-defined grouping of at least two logical access paths that share at least one of the logical path attribute value or are within a range of predefined logical path attribute values.

9. (Original) The process of claim 1, wherein collecting configuration information includes polling a SAN device API, simulating a CLI session with a SAN device, communicating with a SAN device using a CIM or SNMP protocol, or a combination thereof.

10. (Previously Presented) The process of claim 1, and further comprising validating a change of the SAN state by

collecting SAN event description information, and
processing the SAN event description information to identify SAN logical access paths that have access path attribute values that do not comply with the SAN access path policy, thereby indicating a changed SAN state.

11. (Currently Amended) A process for validating a state change event of a storage area network (SAN), comprising the steps of:

defining a SAN access path policy representative of SAN logical access paths, said SAN logical access paths defining end-to-end access relationships between an

Art Unit: 2457

application on a server, a sequence of one or more switches and physical links in the SAN, and data LUNs stored on storage devices in the SAN and having for the logical access paths an associated set of logical access path attributes consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, wherein the SAN access path policy includes a list of valid access paths and an associated set of access path attributes for the valid access paths,

collecting configuration information from devices of the SAN, standardizing formats of the configuration information and reconciling conflicts,

processing the collected configuration information to identify the SAN logical access paths, and computing the associated logical access path attribute values,

defining a SAN state based on SAN logical access paths and attribute values associated with the logical access paths consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path,

obtaining SAN event description information, and

comparing the SAN event description information with the SAN state to identify [[a]] any logical path discrepancies or violations, thereby validating the state change event of the SAN.

Art Unit: 2457

12. (Original) The process of claim 11, and further defining a SAN change plan and comparing the SAN event description information with the SAN change plan.

13. (Original) The process of claim 11, wherein the SAN change event is selected from the group consisting of an erroneous change in a SAN device configuration, a planned change in a SAN device configuration and a device failure.

14. (Original) The process of claim 11, wherein the SAN event description is obtained by at least one of polling, trapping after an event occurs, by a direct administrator input, by an input from a provisioning system about an intended change, by intercepting a change command before an event occurs.

15. (Currently Amended) A storage area network (SAN) validation manager, comprising:

a policy engine that stores a SAN access path policy representative of SAN logical access paths, said SAN logical access paths defining end-to-end access relationship between an application on a server, a sequence of one or more switches and physical links in the SAN, and data LUNs stored on storage devices in the SAN and having for the logical access path attributes with an associated set of logical access path attributes values consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path,

and a number of allocated ports for a valid logical access path, wherein the SAN access path policy includes a list of valid access paths and an associated set of access path attributes for the valid access paths,

a validation engine that collects configuration information from devices of the SAN, standardizes formats of the configuration information and reconciles any conflicts, the validation engine further processing the collected configuration information to identify the SAN logical access paths and computing the associated logical access path attribute values, and comparing the identified SAN logical access paths and computed logical access path attribute values with the list of valid access paths and associated set of access path attributes for the valid access paths in the SAN access path policy to identify any logical access path discrepancies or violations.

16. (Currently Amended) The SAN validation manager of claim 15, further comprising a change engine that collects SAN event description information, and processes the SAN event information to identify SAN logical access paths that have access path attribute values that do not comply with the SAN access path policy, thereby indicating a changed state of the SAN.

17. (Previously Presented) The process of claim 1, wherein processing the collected configuration information to identify the SAN logical access paths and computing the associated access path attribute values includes:

constructing a graph representation of the network topology such that each node in the graph represents a device, and each edge represents an information flow capability between two devices, wherein the information flow capability is determined by analyzing a physical communication link between the two devices and logical configuration settings on the two devices.

18. (Previously Presented) The process of claim 17, wherein identifying the SAN logical access paths and computing the associated access path attribute values further includes:

analyzing the network topology of the constructed graph, wherein analyzing the topology comprises enumerating sequences of edges from nodes representing hosts to nodes representing data on storage devices, and

characterizing each node and each edge in terms of the logical configuration setting.

19. (Previously Presented) The process of claim 18, wherein determining the access path attributes further includes:

analyzing the identified sequences of edges in the constructed graph,
enumerating a plurality of distinct logical access paths leading from a first node representing a host to a second node representing data on a storage device, and

analyzing at least one of the number of hops, a level of end-to-end redundancy, and the number of allocated ports of each of the logical access paths, wherein the first node and the second node are different nodes.

20. (Previously Presented) The process of claim 11, wherein processing the collected configuration information to identify the SAN logical access paths and computing the associated access path attribute values includes:

constructing a graph representation of the network topology such that each node in the graph represents a device, and each edge represents an information flow capability between two devices, wherein the information flow capability is determined by analyzing a physical communication link between the two devices and logical configuration settings on the two devices.

21. (Previously Presented) The process of claim 20, wherein identifying the SAN logical access paths and computing the associated access path attribute values further includes:

analyzing the network topology of the constructed graph, wherein analyzing the topology comprises enumerating sequences of edges from nodes representing hosts to nodes representing data on storage devices, and

characterizing each node and each edge in terms of the logical configuration setting.

22. (Previously Presented) The process of claim 21, wherein determining the access path attributes further includes:

analyzing the identified sequences of edges in the constructed graph,

enumerating a plurality of distinct logical access paths leading from a first node representing a host to a second node representing data on a storage device, and

analyzing at least one of the number of hops, a level of end-to-end redundancy, and the number of allocated ports of each of the logical access paths, wherein the first node and the second node are different nodes.

23. (Previously Presented) The process of claim 15, wherein processing the collected configuration information to identify the SAN logical access paths and computing the associated access path attribute values includes:

constructing a graph representation of the network topology such that each node in the graph represents a device, and each edge represents an information flow capability between two devices, wherein the information flow capability is determined by analyzing a physical communication link between the two devices and logical configuration settings on the two devices.

Art Unit: 2457

24. (Previously Presented) The process of claim 23, wherein identifying the SAN logical access paths and computing the associated access path attribute values further includes:

analyzing the network topology of the constructed graph, wherein analyzing the topology comprises enumerating sequences of edges from nodes representing hosts to nodes representing data on storage devices, and

characterizing each node and each edge in terms of the logical configuration setting.

25. (Previously Presented) The process of claim 24, wherein determining the access path attributes further includes:

analyzing the identified sequences of edges in the constructed graph,
enumerating a plurality of distinct logical access paths leading from a first node representing a host to a second node representing data on a storage device, and

analyzing at least one of the number of hops, a level of end-to-end redundancy, and the number of allocated ports of each of the logical access paths, wherein the first node and the second node are different nodes.

Allowable Subject Matter

Claims 1-25 are allowed.

The following is an Examiner's statement of reasons for allowance:

The prior arts in record fail to teach "logical access path attributes consisting of at least one of a number of hops within a valid logical access path, a level of end-to-end redundancy for a valid logical access path, and a number of allocated ports for a valid logical access path, wherein the SAN access path policy includes a list of valid access paths and an associated set of access path attributes for the valid access paths", as recited in independent claims 1, 11 and 15.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to El Hadji M Sall whose telephone number is 571-272-4010. The examiner can normally be reached on 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ario Etienne can be reached on 571-272-4001. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

Art Unit: 2457

For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/El Hadji M Sall/

Examiner, Art Unit 2457

/Salad Abdullahi/

Primary Examiner, Art Unit 2457